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Finite Size Effects in Electrical Transport in Nanowires and Nanowire-like Devices.

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Semiconductor nanowires possess many unique qualities including high crystallinity, simple growth techniques compatible with a variety of low cost substrates, increased ability to accommodate strain, and nanoscale dimensions not easily accessible by 'top-down' lithographic means. These and other interesting characteristics have made nanowires an attractive topic for fundamental research, as well as for potential applications in nanoelectronics, photonics, sensors, and more recently energy conversion and storage. Most of these applications rely on charge transport, which can be profoundly affected by the high aspect ratio, high surface to volume ratio and nanoscale diameter typical of semiconductor nanowires. Properly identifying the factors that influence electrical transport characteristics is important for device design but also because extraction of material parameters such as the mobility relies on analysis with specific models. In my talk I will discuss several specific examples where nanoscale dimensions and geometry profoundly affect transport and device characteristics, including GaN and GaN/III-N core/shell nanowires; Si radial pn-junction photovoltaics; and all-nanowire Li-ion batteries..