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Quantum Transport in Crossbar Devices BRANDON COOK, PETER DIGNARD, KALMAN VARGA, Vanderbilt Univeristy — Electronic devices with crossbar geometries have recently been fabricated with nanoscale features (Zhong. et al, Science Vol. 302). Consisting of a two dimensional grid of wires, devices have been formed with a variety of components including carbon nanotubes and semiconductor nanowires. These devices are assumed to operate classically, but as the dimensions of the device shrink consideration of quantum effects becomes necessary. We consider a single junction between two wires up to a four by four grid of wires. Through a series of calculations with atomistic first-principles, tight-binding and analytic models of multi-terminal devices we demonstrate the presence of unique behavior, such as interference effects, not present in classical models. It is expected that exploitation of these effects will useful in the creation of circuit components.

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