# NANO HIGHLIGHT
## Coherent Flow of Electron Waves

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*NSF NSEC Grant 0117795*
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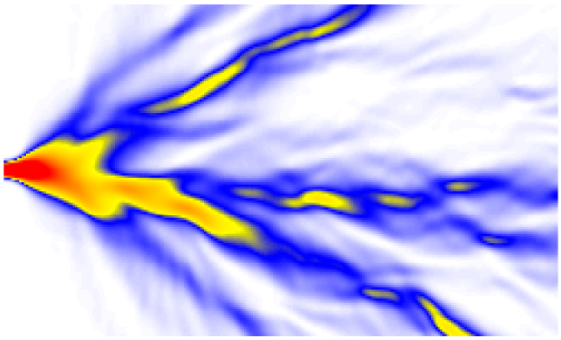
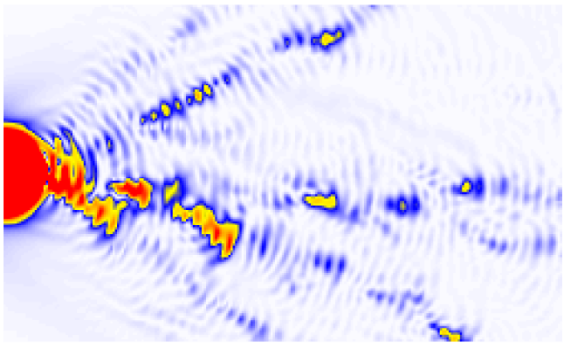
Simulations of the quantum flux density of electron flow in a two-dimensional electron gas from a quantum point contact (QPC).



Simulated SPM image of electron flow from a QPC - the change in QPC conductance from electron waves backscattered from a charged SPM tip is plotted as the tip is scanned over the sample.



Images of electron flow through a two-dimensional electron gas inside a semiconductor heterostructure can be obtained using scanning probe microscopes (SPMs) [1]. The flow of electron waves from a quantum point contact (QPC) shows angular modes near the QPC, as well as branches farther away caused by small-angle scattering from ionized donor atoms. Fringes in the images spaced by half the Fermi wavelength demonstrate quantum coherence of the flow. The simulations shown here demonstrate how this imaging technique works. The top panel is a spatial plot of the quantum flux density of electron waves leaving a QPC with no SPM tip present. The bottom panel is a simulation of the image formed by a charged SPM tip that backscatters electron waves arriving from the QPC, changing its conductance. The pattern of flow in the simulated SPM image agrees quite well with the flux density, and shows fringes produced by backscattering like those seen in the experiment.

**References**

[1] M.A. Topinka, R.M. Westervelt and E.J. Heller, "Imaging Electron Flow", Physics Today, in press (Dec 2003)..