"Visualizing quantized one-dimensional channels in InAs nanowires by quasi-particle interference" by Abhay Kumar Nayak

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Extended phase coherence of hot electrons in InAs nanowires revealed by scanning tunneling microscopy JONATHAN REINER, ABHAY KUMAR NAYAK, NURIT AVRAHAM, ANDREW NORRIS, Weizmann Institute of Science, BINGHAI YAN, Max Planck Institute for Chemical Physics of Solids, ION COSMA FULGA, JUNG-HYUN KANG, Weizmann Institute of Science, TORSTEN KARZIG, Microsoft Research, Station Q, University of California, HADAS SHTRIKMAN, HAIM BEIDENKOPF, Weizmann Institute of Science — The higher the energy of a particle is above equilibrium the faster it relaxes due to the growing phase-space of available electronic states to interact with. Upon relaxing phase coherence is lost, thus limiting high energy quantum control and manipulation. We show that the phase decoherence induced by relaxation of hot electrons in one-dimensional semiconducting nanowires evolves non-monotonically with energy such that above a certain threshold hot-electrons regain stability with increasing energy. We directly observe this phenomenon in InAs nanowires using scanning tunneling microscope by two different measurement schemes: by visualizing the phase coherence length of electronic interference patterns, and by visualizing their phase coherence time, captured by crystallographic Fabry-Perot resonators. A remarkable agreement with a theoretical model reveals that the non-monotonic behavior is driven by the unique manner in which one dimensional hot-electrons interact with the cold electrons occupying the Fermi-sea.

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