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Visualizing Quantized One Dimensional Channels in InAs Nanowire by quasi-particle interference ABHAY KUMAR NAYAK, JONATHAN REINER, NURIT AVRAHAM, ANDREW NORRIS, Weizmann Institute of Science, BINGHAI YAN, Max Planck Institute of Chemical Physics of Solids, ION COSMA FULGA, JUNG-HYUN KANG, Weizmann Institute of Science, TORSTEN KARZIG, Microsoft Station Q, HADAS SHTRIKMAN, HAIM BEIDENKOPF, Weizmann Institute of Science — Semiconducting nanowires have captured vast scientific attention ever since the first putative detection of a zero-bias conductance peak possibly signifying a Majorana mode. It has therefore become imperative to study the underlying electronic properties of the semiconducting nanowire to further our understanding of its topological nature. A major experimental obstacle is the brittleness and reactivity of the nanowires, which oxidize once exposed to ambient conditions. By tackling this technological challenge we have been able to study spectroscopically the one-dimensional electronic states in bare InAs semiconducting nanowires using Scanning Tunneling Microscopy. We visualize the Van-Hove singularities and the corresponding quantized one dimensional channels by imaging the quasi-particle interference arising due to the scattering of the electrons from point impurities on the surface of the nanowire. We also image the standing wave pattern that emanates from the nanowire end. Its decay profile reveals strikingly different relaxation properties of the lowest quantized channel compared to higher ones, as well as an uncharted high energy regime of extended phase coherence of electrons in one dimension.

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