Imaging interaction effects in semiconducting nanowires

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Electrons confined to one dimension exhibit various counter-intuitive phenomena. We study semiconducting InAs nanowires in scanning tunnelling spectroscopy. By maintaining the MBE grown nanowires under ultra-high vacuum we are able to atomically resolve their facets and spectroscopically investigate their quasi-one-dimensional electronic states. We find a non-monotonic energy evolution of the phase coherence of hot electrons in one dimension [1]. A theoretical model reveals that the origin of this unique energy-evolution of phase coherence lies in the form of the Coulomb interaction in one-dimension together with the non-linear electronic dispersion. We further study superconducting (aluminium) quantum dots grown epitaxially on the InAs nanowires. The barrier at the Al/InAs interface along with the tip of the STM form a double barrier tunnelling junction, featuring Coulomb gap and charging resonances. This regime allows us to extract the properties of the buried Al/InAs interface including the tunnelling energy barrier across the interface and the band bending at its vicinity. The potential for measurements of topological superconductivity will be discussed.

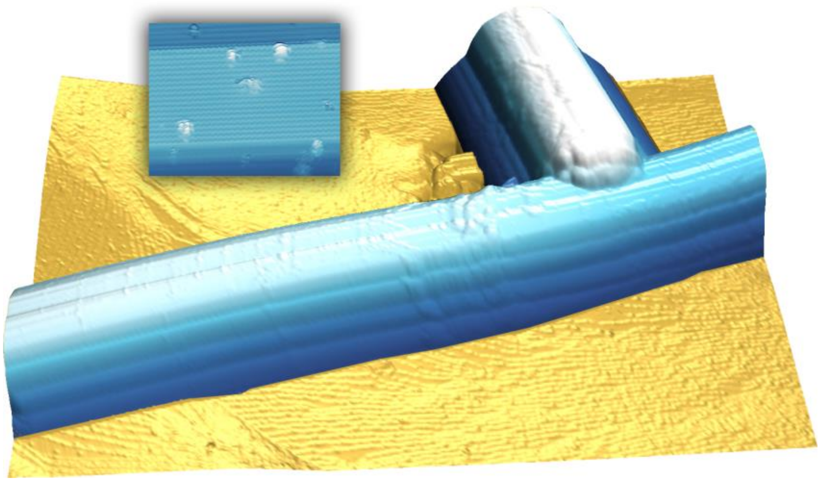

Figure 1: Topographic image of two InAs nanowires on a gold substrate imaged in a scanning tunnelling microscope. The inset shows the atomically resolved {11-20} side facet of the Wurzite nanowire grown along the <0001> direction.

References

1 J. Reiner, *et al.*, *PRX* **7**, 021016 (2017)