Coherent Transport in GaAs/InAs Core/Shell Nanowires

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Modern epitaxial growth technology of semiconductor nanowires allows the formation of complex axial and radial heterostructures and the combination of materials having large lattice mismatches. In this context, radial heterostructure nanowires made of a GaAs core and a surrounding InAs shell are a very interesting system [1, 2]. Here the low bandgap InAs shell forms a cylindrical tube-like conductor around the high bandgap GaAs core.

In this contribution, we present magneto-transport measurements of the GaAs/InAs core/shell nanowires at different temperatures in a magnetic field applied alongside the wire axis (see Fig. 1). Aharonov-Bohm Oscillations with h/e periodicity are found in the conductance of the wires (see Fig. 2). The appearance of the flux quantum period can be explained by one-dimensional transport through angular momentum states [3].

The oscillations are visible at temperatures up to 50 K, indicating a long phase coherence length (see Fig. 3). The GaAs/InAs core/shell heterostructures are therefore an excellent system for studying phase coherent transport effects in semiconductor nanowires.

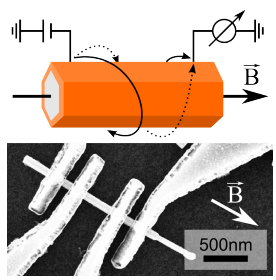

Fig. 1: Measurement setup of a core/shell wire.

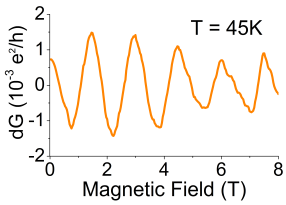

Fig. 2: Nanowire conductance without a slowly varying background.

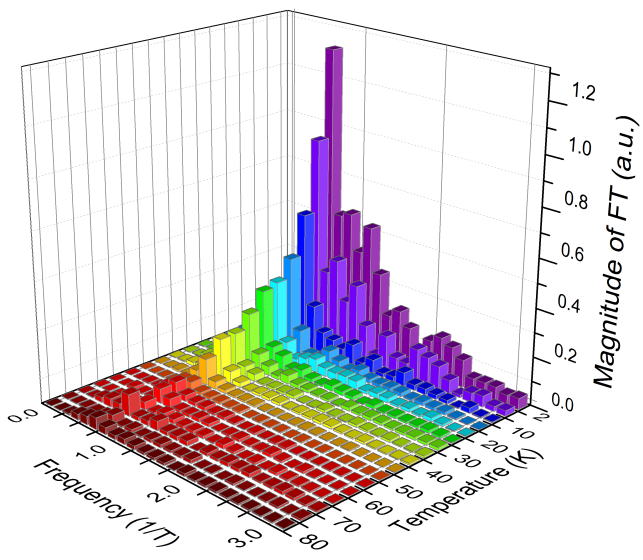

Fig. 3: Fourier transformation of the h/e magneto-conductance oscillations of a GaAs/InAs core/shell nanowire in an axially oriented magnetic field.

[1] F. Haas et al. (2013) Nanotechnology **24** 085603.
[2] T. Rieger et al. (2012) Nano Letters **12**(11) 5559.
[3] C. Blömers et al. (2013) Nanotechnology **24** 035203.