Supporting Information to Accompany:

Quantum interference in radial heterostructure nanowires

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1. Synthesis of heterostructure nanowire

Synthesis of In_2O_3/InO_x core/shell heterostructure nanowire. Gold nanoparticles were deposited on an alumina substrate, and the substrate was placed in a quartz tube furnace. In (99.99%) / In_2O_3 (99.99%) mixture was placed in the quartz tube reactor. Single-crystalline In_2O_3 nanowire cores were grown at 900–1000 °C. Details of the nanowire cores were reported elsewhere[1]. After the growth of core, the growth temperature was decreased gradually, which produced amorphous InO_x nanowire shells were formed on the nanowire surfaces. After the growth, the nanowires were transferred onto an n^+-Si substrate with a 500-nm-thick SiO_2 top layer.

Reference:

1. Chun, H. J., Choi, Y. S., Bae, S. Y., Choi, H. C. & Park, J. Single-crystalline gallium-doped indium oxide nanowires. *Appl. Phys. Lett.* **85**, 461–463 (2004).

2. Supporting Figures

Figure S1

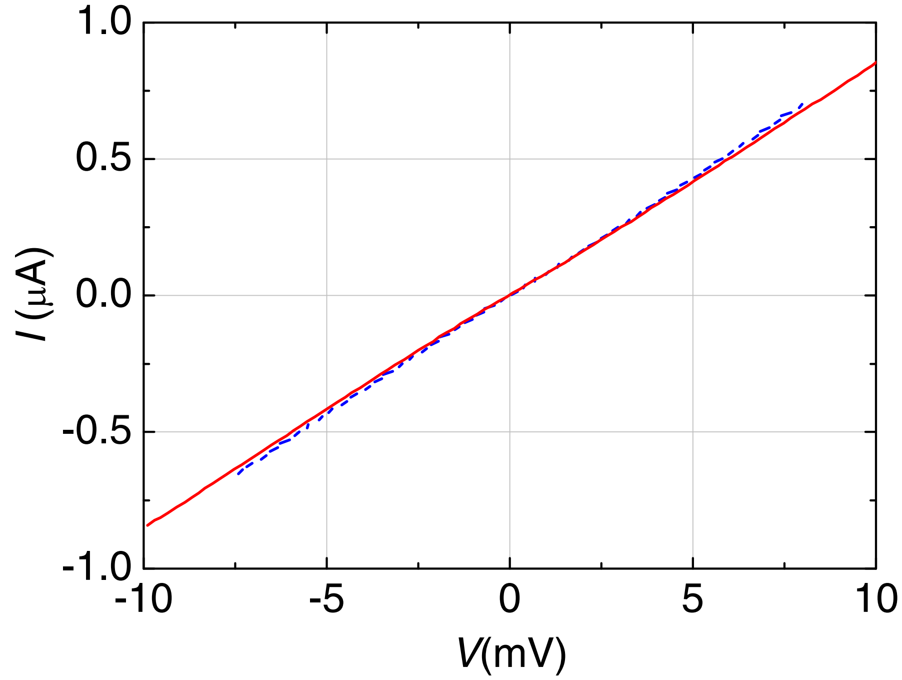

Figure S1. Four- and two-probe measurements. To check the contact resistance, we have measured the *I-V* characteristics of a single device both with four (dashed blue line)- and two (solid red line)-probe measurement configurations. The measured contact resistance, R_c ~ 300 Ω, is about 100 times smaller than the resistance of the nanowire itself.

Figure S2

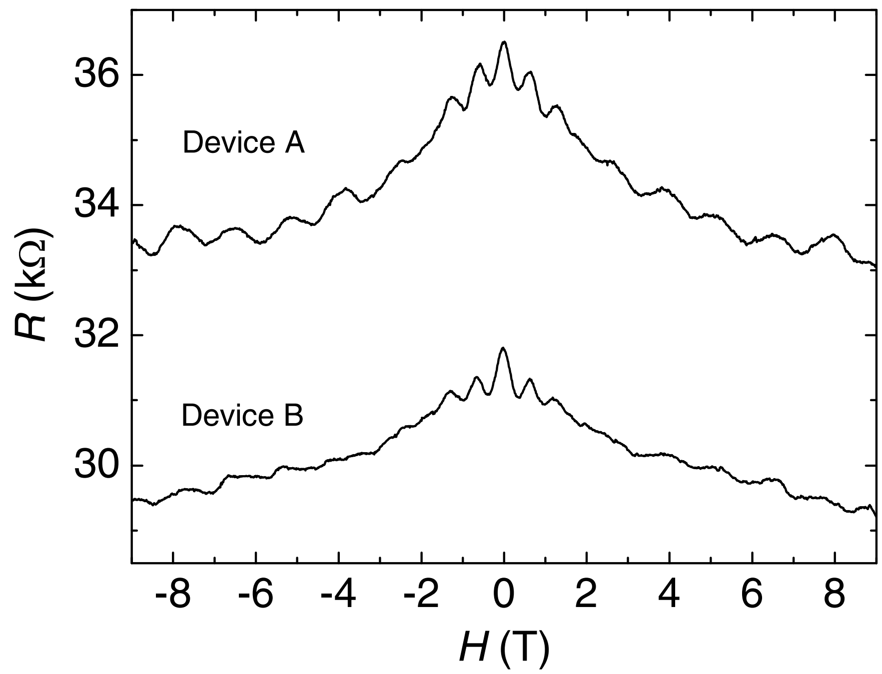

Figure S2. Comparison of the magnetoresistance (MR) of the devices A and B. The MR curves were measured for devices A and B fabricated on a single nanowire. Although there exist about 10% of difference in the two-probe resistances, two devices exhibited almost identical MR features.

Figure S3

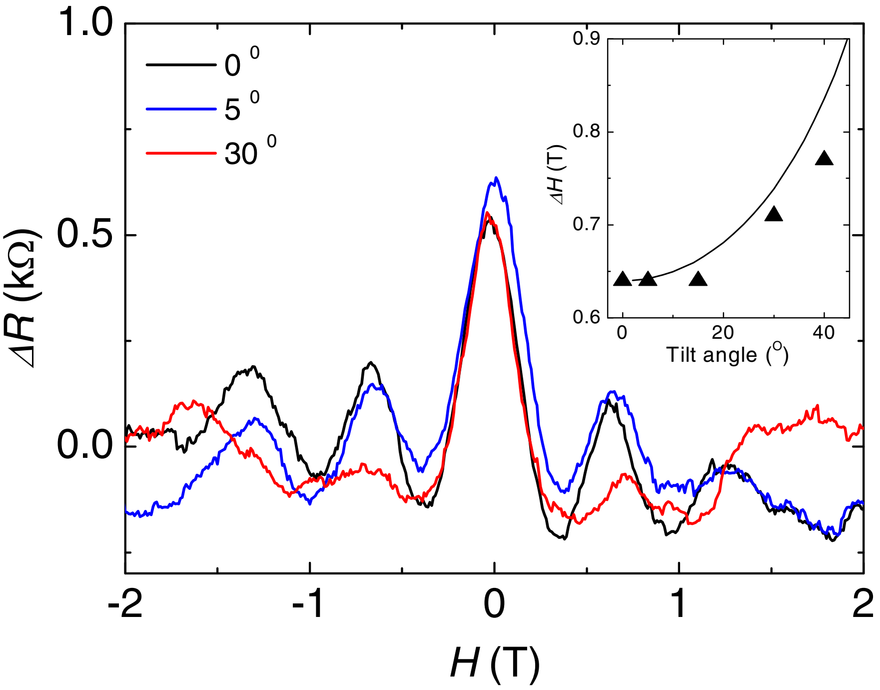

Figure S3. Angle-dependence of the AAS oscillation. The change of the MR curve with the tilt angle θ is shown; 0° (black), 5° (blue), and 30° (red). Inset shows the first oscillation period as a function of the tilt angle. The oscillation period fits relatively well to the expected 1/cosθ-law (solid line).

Figure S4

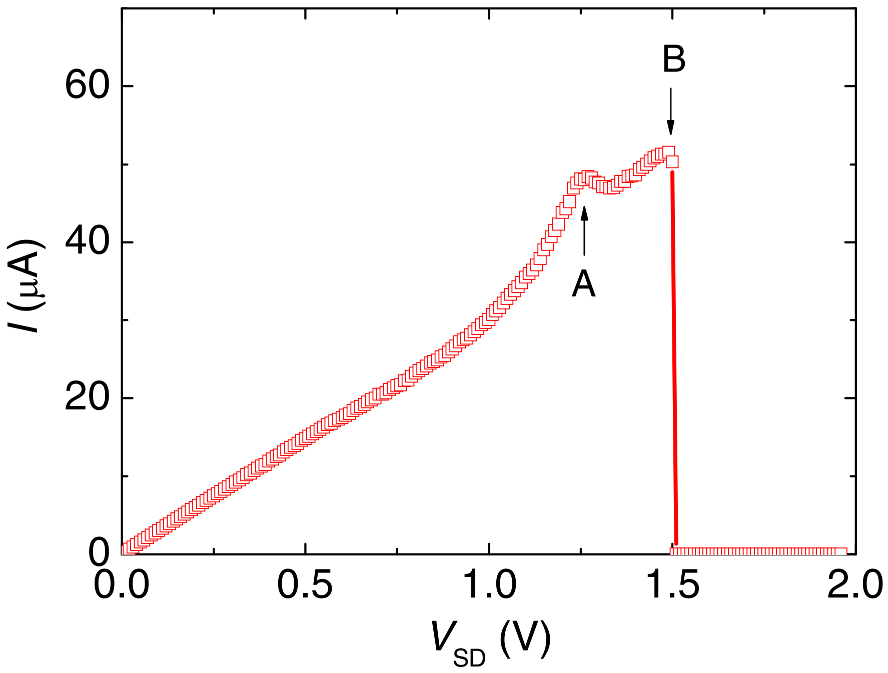

Figure S4. High bias characteristics of device C. We have measured high-bias characteristics of the device C. With high-enough bias voltage, abrupt drop of current due to the breakdown of the nanowire was observed. For our devices, two-step breakdown, denoted as A and B, were generally observed. At the point A, the current does not go to zero and the breakdown of the outer shell part is presumed. At the point B, current drops to zero, indicating breakdown of the nanowire core.

Figure S5

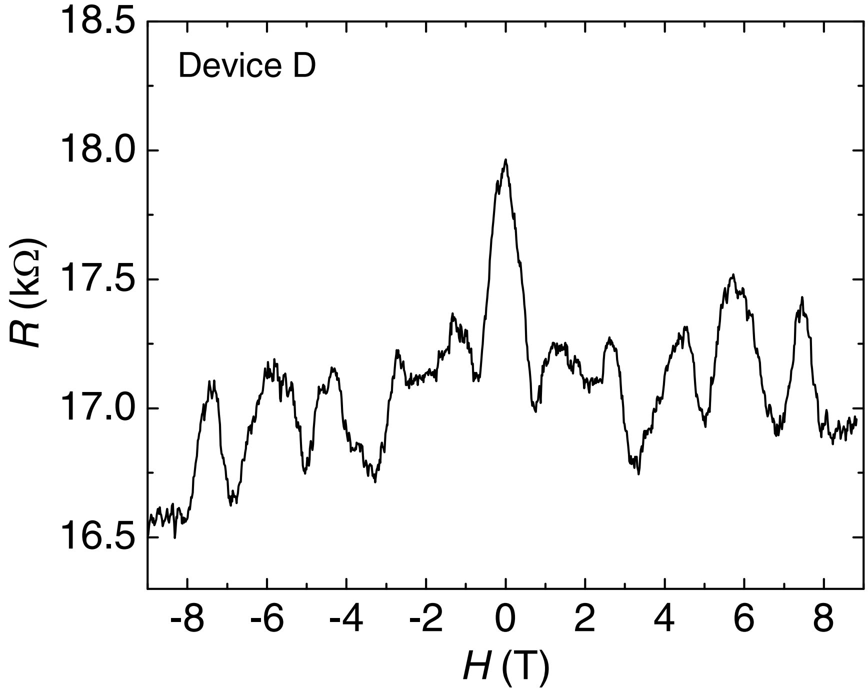

Figure S5. Magnetoresistance curve of device D. The magnetoresistance curve of device D was measured at 2 K. The width and length of the nanowire are 80 nm and 500 nm, respectively. The robustness of AB oscillation at high field is evident.