Single-Electron Transport with Acousto-Electric Chirp Pulses for Quantum Applications

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Abstract

A surface acoustic wave (SAW) can transfer a single-electron between distant quantum dots [1,2], resulting in a promising platform for the implementation of electronic flying qubits [3-6]. The inconvenience in these experiments is that a relatively long SAW train (~100 minima) is generated, but only a single minimum is required for the electron transfer [7]. These additional SAW minima make the exact location of the electron during the transfer ambiguous and lead to unwanted perturbation of the quantum state of the electron [6]. Here we demostrate the generation of a single moving SAW minimum using a chirp interdigital transducer with a single-electron transfer efficiency above 99.5%. Owing to the simplicity to synchronise several single-electron sources and the high transfer efficiency, our results represent a paradigm shift for SAW-driven quantum-transport experiments.

References

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Figures

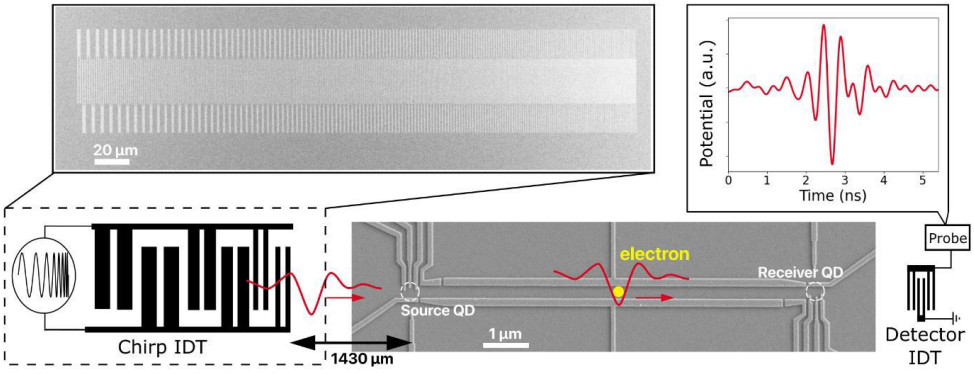

Figure 1: SEM image of the SAW-driven single-electron circuit with a chirp interdigital transducer (IDT). The engineered SAW comprises a single minimum which transfers a single electron from the source quantum dot (QD) to the receiver quantum dot. Top right: measured shape of the SAW from the wideband detector IDT.