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Conveyor-mode single-electron shuttling in Si/SiGe

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We demonstrate shuttling of a single electron by a propagating wave-potential in an electrostatically defined 420 nm long Si/SiGe quantum-channel [1]. This conveyor-mode shuttling approach requires only four sinusoidal control signals independent from its length. The tuning of the signal parameters is straightforward and we observe a high single-electron shuttling fidelity of 99.42 % including a reversal of direction. We show numerical device simulations including charged defects and discuss spin-dephasing mechanisms expected during conveyor-mode shuttling in Si/SiGe and the perspective for spin-coherent shuttling with a transfer fidelity of at least 99.9 % across a distance of 10 µm [2].
[1] I. Seilder et al., arXiv:2108.00879 (2021); accepted for npj Qant. Inf.
[2] V. Langrock et al., arXiv:2202.11793 (2022).

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