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Exploiting the nonlinear dynamics of a single-electron shuttle for highly regular current transport MICHAEL MOECKEL, University of Cambridge, F. MARQUARDT, University of Erlangen, Germany, D. SOUTHWORTH, E. WEIG, University of Munich, Germany — A single-electron shuttle consists of a small metallic island (a quantum dot) resting on a nanomechanical resonator which oscillates between two electrodes. This setup has been suggested as a promising way to deliver single electrons one by one and thereby establish a novel current standard. The precision of charge transport will be determined both by the accuracy of charge quantization in the Coulomb blockade regime and the mechanical frequency. The later is generally affected by several not entirely controllable factors. Among those is the nonlinear dynamics which originates from collisions of the shuttle island with the electrodes at higher oscillation amplitudes. Instead of considering this a nuisance, we propose to rather exploit the nonlinearity to fix the oscillation frequency precisely to an external signal via synchronization.

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