Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

Charge pumping by a surface acoustic wave in an undoped quantum well: a potential single-photon source S.K. SON, Y. CHUNG, Cavendish Laboratory, University of Cambridge, UK, J. PEDROS, Technical University of Madrid, Spain, C.J.B. FORD, C.H.W. BARNES, J.P. GRIFFITHS, G.A.C. JONES, I. FARRER, D.A. RITCHIE, Cavendish Laboratory, University of Cambridge, UK
— Single-electron transfer between distant quantum dots using the potential minima of surface acoustic waves (SAWs) has been demonstrated recently, with possible applications for quantum computation. We have developed a technique to induce electrons and holes in an undoped GaAs/AlGaAs quantum well in different regions of the same device using gates, and to transport a stream of single electrons or holes along a narrow, empty channel using SAWs. The potential has a steep slope at the edges of the inducing gates, but we have modelled the potential profile of the active region to find designs in which the potential slope is shallow enough to allow the SAW potential to drag electrons out of the induced region, towards the region of holes. Recombination of each electron with one of the holes should produce a photon and we are investigating the use of this device as a single-photon source. If the electrons are spin-polarised then their spins can be detected by measuring the circular polarisation of the photons, and this may be useful for spin readout in a quantum processor, or as part of a quantum repeater in quantum cryptography.

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Date submitted: 14 Dec 2012 Electronic form version 1.4