Abstract Submitted
for the MAR09 Meeting of
The American Physical Society

Observation of tunnel rates of phosphorus dopants using silicon SETs H. HUEBL, C.D. NUGROHO, A. MORELLO, C. ESCOTT, A.S. DZURAK, R.G. CLARK, Centre for Quantum Computer Technology, University of New South Wales, Sydney, C. YANG, J.V. DONKELAAR, A. ALVES, D. JAMIESON, Centre for Quantum Computer Technology, University of Melbourne, Melbourne, M.A. ERIKSSON, Department of Physics, University of Wisconsin, Madison, Wisconsin — Charge centres, such as donors in semiconductors, have significant potential for quantum information processing. In silicon, which can be produced nuclear-spin free, phosphorus donors are a prime candidate for implementation of a qubit, due to their long spin coherence times. In this presentation we will discuss a hybrid structure, consisting of implanted phosphorus donors controlled by a gate potential in close vicinity to a gate-induced, MOS-based silicon single electron transistor (Si-SET). We study the dual functionality of the nearby Si-SET as a sensitive charge detector as well as a gate-induced electron reservoir. Experimentally, we observe shifts in the position of the Coulomb peaks of the Si-SET corresponding to ∼20% of an electron charge. We attribute these shifts to charge transfers between the Si-SET island reservoir and the nearby phosphorus donors. Pulsed voltage spectroscopy on one of these charge transitions allows us to investigate the capture and emission times of a donor resulting in a capture rate of 3000 s-1 and an emission rate of 1000 s-1 corroborating expectations from device modelling.

Hans Huebl
Centre for Quantum Computer Technology,
University of New South Wales, Sydney, Australia

Date submitted: 18 Dec 2008 Electronic form version 1.4