Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Long-lived qubit constructed from three identical atoms RUI HAN, Centre for Quantum Technologies, Singapore, HUI KHOON NG, Centre for Quantum Technologies, Singapore and DSO, National Laboritories, applied physics lab, Singapore, NIELS LÖRCH, Centre for Quantum Technologies, Singapore and Universitt Heidelberg, Philosophenweg 16-19, 69120 Heidelberg, Germany, JUN SUZUKI, National Institute of Informatics, 2-1-2 Hitotsubashi, Chiyoda ku, Tokyo 101-8430, Japan, BERGE ENGLERT, Centre for Quantum Technologies, National University of Singapore, Singapore — In this talk, I will present a scheme for constructing logical qubits from clusters of three identical atoms that are long-lived against decoherence from fluctuating magnetic fields, a limiting source of noise in many experiments. Each qubit is stored in a rotationally invariant subsystem of the total angular momentum states of the three atoms, and can persist with high fidelity for time-scales on the order of hours. This is to be compared with a fraction of a millisecond for an unprotected atomic qubit. I will first present the scheme of rotationally invariant subsystems in atomic systems and show that the information stored in the system is robust against decoherence. Then I will move on to discuss a proposal for an experiment to demonstrate the feasibility of the scheme. In our proposal, the state preparation is done with the help of Rydberg blockade for three atoms, where the atoms are localized in space and addressed by a sequence of laser pulses simultaneously. By carefully selecting the atomic levels addressed and tuning the parameters of the applied lasers, an arbitrary logical qubit state can be prepared. Lastly, the fidelity of state preparation will be discussed. Ref: R. Han, N. Lörch, J. Suzuki and B. G. Englert, Phys. Rev. A 84, 012322 (2011)

Rui Han
Centre for Quantum Technologies, Singapore

Date submitted: 07 Dec 2011 Electronic form version 1.4