Abstract Submitted for the DAMOP11 Meeting of The American Physical Society

Microwave Near-Field Quantum Control of Trapped-Ion Qubits¹ U. WARRING, C. OSPELKAUS, K.R. BROWN, Y. COLOMBE, J.M. AMINI, D. LEIBFRIED, D.J. WINELAND, National Institute of Standards and Technology; 325 Broadway, Boulder, Colorado 80305, USA — A major concern in the development of a future quantum processor is the scalability toward large numbers of qubits; its structure should enable one- and multi-qubit gates on arbitrarily selected qubits. As for a classical processor, micro fabrication might lead to a promising route to build such a versatile ion-qubit quantum processor. Recent experiments with surface electrode ion traps have demonstrated the key ingredients for scalable ion loading, transporting, and trapping architecture. Here, we present an approach to incorporate also the ion-qubit manipulation into the surface-electrode structure.² It is based on an oscillating magnetic field generated by microwave currents in electrodes of a micro fabricated surface-electrode trap. The homogeneous field component is used to implement single-qubit gates, while the field gradient leads to a coupling of the ions internal and motional states. With further improvements, this coupling can be deployed to entangle multi-qubits.

¹Supported by IARPA, NSA, DARPA, ONR and the NIST Quantum Information Program.

²C. Ospelkaus, *et al.* Phys. Rev. Lett. 101, 090502 (2008).

Ulrich Warring National Institute of Standards and Technology; 325 Broadway, Boulder, Colorado 80305, USA

Date submitted: 03 Feb 2011

Electronic form version 1.4