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Scalable quantum computing with highly magnetic atoms ANDREI DEREVIANKO, CALEB CANNON, Department of Physics, University of Nevada, Reno — Considering recent success in cooling and trapping of open shell atoms with large magnetic moments, we propose a quantum computer based on magnetic interactions of such atoms. This architecture is based on cold atoms confined to sites of a tight optical lattice. The lattice is placed in a non-uniform magnetic field and the resulting Zeeman sublevels define qubit states. Microwave pulses tuned to space-dependent resonant frequencies are used for individual addressing. The atoms interact via magnetic-dipole interactions allowing implementation of a universal controlled- NOT gate. The resulting gate operation times are as fast as 100 microseconds, much faster then the anticipated decoherence times. Single qubit operations take about 10 microseconds.
Details can be found in A. Derevianko and C. Cannon, Phys. Rev. A **70**, 062319 (2004).

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