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One-way quantum computing in optical lattices with many atom measurements. TIMOTHY FRIESEN, DAVID FEDER, University of Calgary — With one-way quantum computation universality can be achieved using only single qubit measurements on a highly entangled state, known as a cluster state. By manipulating ultracold atoms in optical lattices it is possible to efficiently generate large, many qubit cluster states. Although this approach is very promising, the small spacing between lattice sites severely restricts our ability to sequentially measure the states of individual atoms by external lasers, a necessary condition for universal computing. Working within the limitations of current technology we must generally consider many atom measurements. We have developed a deterministic protocol for one-way quantum computing based on many atom measurements on an optical lattice cluster state, with only polynomial classical overhead. Our scheme opens the way toward concrete experimental quantum computing in neutral atom systems.

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