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Ion traps, quantum computing, and the measurement problem†

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The basic requirements for quantum computing and quantum simulation (single- and multi-qubit gates, long memory times, etc.) have been demonstrated in separate experiments on trapped ions. Construction of a useful information processor will require synthesis of these elements and implementation of high- fidelity operations on a very large number of qubits. NIST and other groups are addressing this scaling issue by trying to fabricate multi-zone arrays of traps that would allow highly-parallel processing. As the number of qubits increases, the measurement problem in quantum mechanics becomes more glaring; with luck, trapped ion systems might be able to shed light on this fundamental issue.

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