Quantum cellular automata and quantum simulation

PETER LOVE, Haverford College — Quantum information theory can address ground state properties through DMRG-like classical methods, and through proposals for the use of phase estimation-based quantum algorithms. However, the dynamics of quantum systems present greater challenges to both classical and quantum computational methods. Quantum cellular automata provide a simple arena in which to address questions about quantum dynamics. Prior work has yielded decision procedures to determine when the local rule leads to globally unitary dynamics. I will describe a particular class of automata, unitary by construction, and discuss their relevance to the quantum computational complexity of quantum dynamics.