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**Modeling fluid dynamics on type II quantum computers** JAMES SCOVILLE, DAVID WEEKS, Air Force Institute of Technology, JEFFREY YEPEZ, Air Force Research Laboratory — A quantum algorithm is presented for modeling the time evolution of density and flow fields governed by classical equations, such as the diffusion equation, the nonlinear Burgers equation, and the damped wave equation. The algorithm is intended to run on a type-II quantum computer, a parallel quantum computer consisting of a lattice of small type I quantum computers undergoing unitary evolution and interacting via information interchanges represented by an orthogonal matrices. Information is effectively transferred between adjacent quantum computers over classical communications channels because of controlled state demolition following local quantum mechanical qubit-qubit interactions within each quantum computer. The type-II quantum algorithm presented in this paper describes a methodology for generating quantum logic operations as a generalization of classical operations associated with finite-point group symmetries. The quantum mechanical evolution of multiple qubits within each node is described. Presented is a proof that the parallel quantum system obeys a finite-difference quantum Boltzman equation at the mesoscopic scale, leading in turn to various classical linear and nonlinear effective field theories at the macroscopic scale depending on the details of the local qubit-qubit interactions.

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