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Performing measurement based quantum computation on ground states[1] ANDREW DOHERTY, University of Queensland, STEPHEN BARTLETT, University of Sydney — One of the most exciting developments in quantum computing in recent years has been the realisation that there exist states of quantum many-body systems that can serve as a universal resource for quantum computing, where computation proceeds solely through single-qubit measurements. Although currently only a few isolated examples of such universal resource states are known, we discuss the possibility that there exist models of interacting spin systems in which an ordered phase is characterized by the ability to perform measurement-based quantum computation (MBQC). To identify such phases, we propose to use nonlocal correlation functions that quantify the fidelity of quantum gates performed between well separated qubits. The quantum computing phase is then characterized by set of order parameters corresponding to a universal set of quantum gates. We investigate a simple spin-lattice system based on the cluster-state model for MBQC by using a series of dualities with better studied models. We demonstrate that the model possesses a zero temperature phase transition between a disordered phase and an ordered "cluster phase" in which it is possible to perform a large class of one and two qubit quantum gates.

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