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Efficient quantum algorithms for simulating sparse Hamiltonians

A "quantum computer" is a computing device that can exist in a quantum mechanical superposition of several states simultaneously and whose computation paths can interfere with each other. Such computers can perform some remarkable feats, such as efficient integer factorization, which appear to go beyond the capabilities of "classical computers". Another natural and important application area of quantum computers is the efficient simulation of quantum mechanical systems. After some preliminary remarks about quantum computing, we describe some general frameworks in which these simulation problems can be cast and explain how some efficient simulation algorithms work.

This is joint work with Graeme Ahokas, Dominic Berry, and Barry Sanders.