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Universal fault-tolerant adiabatic quantum computing with quantum dots or donors

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I will present a conceptual design for an adiabatic quantum computer that can achieve arbitrarily accurate universal fault-tolerant quantum computations with a constant energy gap and nearest-neighbor interactions. This machine can run any quantum algorithm known today or discovered in the future, in principle. The key theoretical idea is adiabatic deformation of degenerate ground spaces formed by topological quantum error-correcting codes. An open problem with the design is making the four-body interactions and measurements it uses more technologically accessible. I will present some partial solutions, including one in which interactions between quantum dots or donors in a two-dimensional array can emulate the desired interactions in second-order perturbation theory. I will conclude with some open problems, including the challenge of reformulating Kitaev's gadget perturbation theory technique so that it preserves fault tolerance. Sandia National Laboratories is a multi-program laboratory managed and operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation, for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.