# Adiabatic Quantum Transistors

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**Abstract**

The invention of the transistor was a watershed moment in the history of computing: it provided a logic element that was naturally robust to noise and error. Quantum computers offer the potential to exponentially speed up some computational problems, but have not been built in large part because quantum information is notoriously fragile and quickly becomes classical information in the presence of noise. In theory, the quantum threshold theorem asserts that these difficulties can be circumvented, but in practice the requirements of this theorem are daunting. Here we propose a novel method for building a fault-tolerant quantum computer which much more closely mimics the classical transistor. We show how a suitably engineered material can be made to quantum compute by the simple application of an external field to the sample. This construction opens a new path toward the engineering of a large-scale quantum computer with design and control advantages over prior state of the art. Just as a transistor works by causing a phase transition between an insulating and conducting phase conditional on an external electric field, the applied field here causes a phase transition at the end of which a quantum gate has been enacted and quantum information propagated across the device.