CP-11-01

# From a grain of sand to a |quantum⟩ bit of information

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## Abstract

A large scale quantum computer could change the world; calculations in minutes that would take the supercomputers thousands of years. Applications such as cryptography, chemistry, finance, etc are the focus. Today's quantum processors are limited to 10's of entangled quantum bits. If you believe the hype, a commercially relevant system is just around the corner that can outperform our largest supercomputers for useful calculations. The reality, however, is that a commercially relevant system is 10-15 years away.

At Intel, our approach is to rely on the continued evolution of Moore's Law to build qubit arrays with a high degree of process control. Here, we present progress toward the realization of a 300mm Si/SiGe based spin qubit device in a production environment. A spin qubit relies on the spin of a single electron in an external magnetic field to encode the two states of the qubit, where spin up vs down represent 0 vs 1. Spin Qubits are compelling as their appearance and fabrication is similar to conventional CMOS transistors that drive the microelectronics industry. At the same time, they are roughly one million time smaller than the superconducting qubits that are being pursued by other companies.