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Quantum Computing

MATTHIAS STEFFEN, IBM

Quantum mechanics plays a crucial role in many day-to-day products, and has been successfully used to explain a wide variety of observations in Physics. While some quantum effects such as tunneling limit the degree to which modern CMOS devices can be scaled to ever reducing dimensions, others may potentially be exploited to build an entirely new computing architecture: The quantum computer. In this talk I will review several basic concepts of a quantum computer. Why quantum computing and how do we do it? What is the status of several (but not all) approaches towards building a quantum computer, including IBM's approach using superconducting qubits? And what will it take to build a functional machine? The promise is that a quantum computer could solve certain interesting computational problems such as factoring using exponentially fewer computational steps than classical systems. Although the most sophisticated modern quantum computing experiments to date do not outperform simple classical computations, it is increasingly becoming clear that small scale demonstrations with as many as 100 qubits are beginning to be within reach over the next several years. Such a demonstration would undoubtedly be a thrilling feat, and usher in a new era of controllably testing quantum mechanics or quantum computing aspects. At the minimum, future demonstrations will shed much light on what lies ahead.