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AMO Science as an Enabler of Quantum Information Technology

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This talk will present an overview on a decade's worth of innovation and progress toward developing a quantum computer, and suggest future research directions. In the eleven years since Peter Shor's quantum algorithms, quantum information science has become one of the fastest growing areas of physics. The prospect of executing quantum algorithms with no classical counterparts that accomplish tasks far beyond the capabilities of classical computers is one of the grand challenges of modern physics. The quest for quantum computing has inspired the discovery of passive and active forms of error correction, the formulation of compelling concepts for physical quantum bits, and the construction of experimental apparatus to realize them. Steady progress on both the experimental and theoretical fronts is transforming the fundamental tenets of quantum computing from a theoretical notion to a proven reality. The search for suitable physical systems has promoted the cross-pollination of ideas and language between atomic, molecular, and optical physics and solid-state physics, to the advantage of both communities.