DE MADRID AL COSMOS

Topological Quantum Computation - From Concepts To Experiment

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Abstract: Quantum computers hold the promise to allow one to solve problems that cannot be efficiently treated on classical computers. To date, the construction of a quantum computer remains a fundamental scientific and technological challenge, due the influence of unavoidable noise which affects the fragile quantum states.

In our talk, we begin with a general introduction to quantum computation and then introduce the basic idea of quantum error correction based on topological quantum codes, which allow one to protect quantum information during storage and processing. We then discuss a recent experimental realization of a quantum error correcting code in which a logical qubit was distributed over seven trapped-ion qubits. This encoding not only allowed us to detect arbitrary single-qubit errors, but also to realize for the first time quantum computations on an encoded qubit. This quantum error correcting code represents a fully functional instance of a topologically encoded qubit, or color code, and opens a route toward fault-tolerant quantum computing.

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