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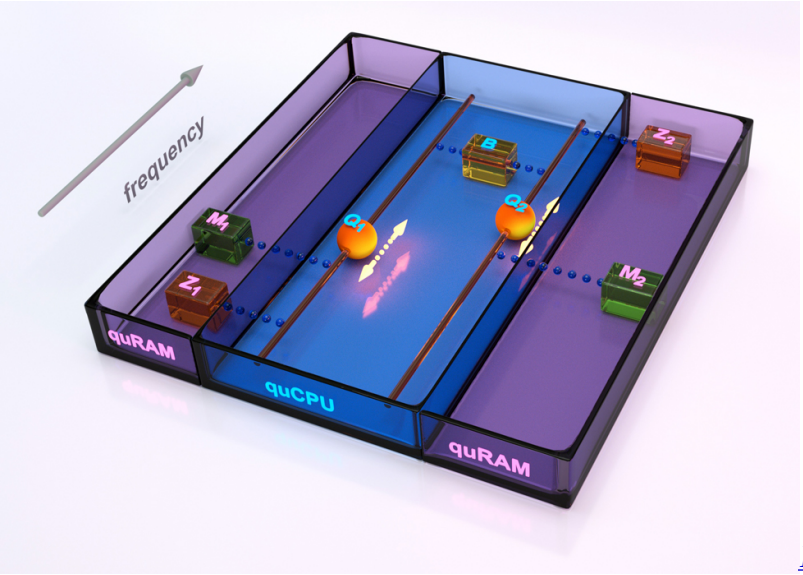
UCSB Quantum Computing Research Among Top 10 Physics Breakthroughs of 2011



Physics World revealed its Top 10 breakthrough stories in physics for 2011, and quantum computing research at UCSB made the list.

Research by UC Santa Barbara postdoctoral fellow Matteo Mariantoni, and professors Andrew Cleland and John Martinis placed #9 among the Top 10 breakthroughs, for "being the first to implement a quantum version of the "Von Neumann" architecture found in PCs."

"Based on superconducting circuits and integrated on a single chip, the new device has been used to perform two important quantum-computing algorithms. Its development moves us closer to the creation of practical quantum computers that solve real-life problems," writes Hamish Johnston, editor of *physicsworld.com.*

Mariantoni discusses their breakthrough in depth on the blog 2Physics.com . He writes:

> "One of the critical challenges of quantum computing is to assemble together in a single machine all the hardware components needed for a quantum computer and to program these components using quantum codes, thus allowing us to implement a quantum-mechanical computational architecture. In particular, such an architecture should be scalable and immune from computational errors. This would represent a so-called scalable fault-tolerant quantum-mechanical architecture."
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> "In the past years, at UCSB as well as in other labs worldwide we have shown that it is possible to prepare and control systems with a few qubits (up to three). In particular, we have shown superposition states and entangled states, and we have been able to perform simple quantum logic gates using one and two qubits."
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> "However, qubits alone are insufficient to implement a quantum-mechanical analogous of the von Neumann architecture: A quantum memory is needed. In the experiment to be published

in the journal Science [4], we were able to fabricate a fairly complex quantum circuit comprising all the elements of a quantum von Neumann machine, integrated on a single chip."

In our Fall 2011 issue of Convergence magazine, we highlight the amazing efforts that Martinis, Cleland, Mariantoni and others have invested in quantum computing research at UCSB in the article "Quantum Leap."

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Physics World: Top 10 Physics Breakthroughs

Convergence Magazine: "Quantum Leap"

2Physics.com: Mariantoni on the Quantum von Neumann Architecture

Public Affairs News Release
