Nano-diamond qubits and photonic crystals

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Quantum information processing is arguably one of the most fascinating facets of modern quantum physics.

A quantum computer operates with quantum bits (qubits) as units of information. Obeying the laws of quantum mechanics, such a computer would be capable of addressing several of the most difficult computational tasks unsolvable with present technology. In the past few decades, scientists learned to perform room-sized experiments to optically control and read out a small number of qubits.

Now, researchers in Germany have successfully fabricated a rudimentary quantum computing hybrid system using electronic excitations in nano-diamonds as qubits and optical nanostructures, so-called photonic crystals with tailored optical properties. This architecture may allow integration of multi-qubit systems on a single micrometer-sized chip for future quantum computers.

"Our results suggest a strategy for scaling up quantum information to large-scale systems, which has yet to be done," says Janik Wolters, researcher, at Humboldt Universität in Berlin. "We regard our experiment as a milestone on the long road toward on-chip integrated quantum information processing systems, bringing the dream of a quantum computer closer to reality."

More information: The article, "Enhancement of the zero phonon line emission from a single nitrogen vacancy center in a nanodiamond via coupling to a photonic crystal cavity" by Janik Wolters, Andreas W.