Coupling Superconducting Flux Qubits to Impurities in Silicon

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The realization of a quantum computer represents a tremendous scientific and technological challenge due to the extreme fragility of quantum information. The physical support of information, namely the quantum bit or qubit, must at the same time be strongly coupled to other qubits by gates to compute information, and well decoupled from its environment to keep its quantum behavior.

An interesting physical system for realizing such qubits are magnetic impurities in semiconductors, such as bismuth spins in silicon. Indeed, spins in semiconductors can reach extremely long coherence times - of the order of seconds. Yet it is extremely difficult to establish and control efficient gates between distant spins. Here we experimentally demonstrate a protocol where single spins can coherently transfer their quantum information to a superconducting device, which acts as a mediator or quantum bus. This superconducting device allows to connect distant spins on-demand without compromising their coherent behavior.

References

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