Quantum Physics

Prospects for measurement-based quantum computing with solid state spins

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This article aims to review the developments, both theoretical and experimental, that have in the past decade laid the ground for a new approach to solid state quantum computing. Measurement-based quantum computing (MBQC) requires neither direct interaction between qubits nor even what would be considered controlled generation of entanglement. Rather it can be achieved using entanglement that is generated probabilistically by the collapse of quantum states upon measurement. Single electronic spins in solids make suitable qubits for such an approach, offering long coherence times and well defined routes to optical measurement. We will review the theoretical basis of MBQC and experimental data for two frontrunner candidate qubits -- nitrogen-vacancy (NV) centres in diamond and semiconductor quantum dots -- and discuss the prospects and challenges that lie ahead in realising MBQC in the solid state.

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