UNIVERSITÄT LEIPZIG

Fakultät für Physik und Geowissenschaften

Prof. Dr. J. Deiglmayr
Prof. Dr. J. Vollmer

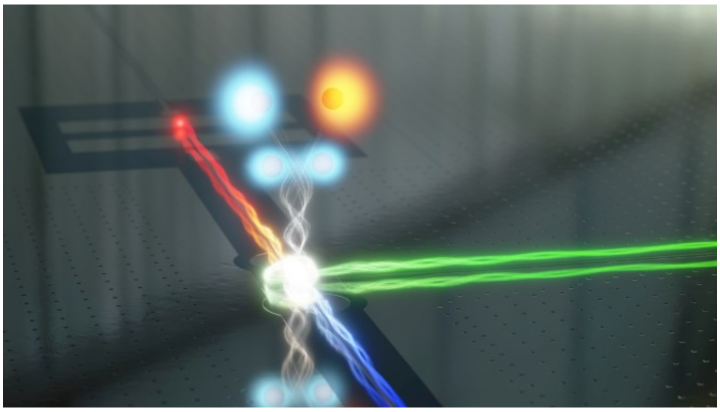
Physics Colloquium

Tuesday, 1 June 2021 at 17:00

Prof. Dr. Stefan Filipp

Walther-Meißner-Institut, Garching, Germany

Controlling superconducting quantum circuits for quantum computing



The rapid development of quantum technologies has brought us a step closer to operational quantum computers that hold promise to outperform conventional computers in certain types of problems. While a large number of qubits is necessary to run complex algorithms, fast and high-fidelity gate operations of different types are as important. We utilize a system based on fixed-frequency superconducting qubits that are characterized by their stability, relatively long coherence times and scalability. On this platform, we explore different ways to increase the performance of future quantum processors. We demonstrate that optimal control techniques allow us to shape microwave control pulses and realize fast single-qubit pulses without sacrificing fidelity. We also explore measurement techniques with a high duty cycle to overcome the challenge of time-consuming optimization sequences. Since exchange-type gates preserve the number of qubit excitations, these are particularly well suited for quantum chemistry algorithms in which the number of electrons in the molecule is fixed. With this choice of gates we can make best use of the available hardware and realize short algorithms that finish within the coherence time of the system. With gate fidelities around 95% we compute the eigenstates within an accuracy of 50 mHartree on average, a good starting point for near-term applications with scientific and commercial relevance.

Online Colloquium broadcasted by BigBlueButton at

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