Advancing Quantum Information Processing with Superconducting Circuits

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Quantum computers have the potential to solve complex problems efficiently. However, to unleash their full potential, complex quantum systems have to be manufactured, manipulated and measured with unprecedented accuracy and precision. In this presentation I will focus on superconducting qubits as one of the most promising platforms for quantum computing. I will illustrate the building blocks of a quantum processor using a system based on 17 transmon-type qubits, which we are currently operating in our laboratory. In this architecture tunable coupling elements are harnessed to generate multi-qubit operations between two or more qubits and to efficiently create many-body entanglement. Moreover, I will address alternative superconducting qubits with improved protection against environmental influences.